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Time Controls for Schroeder and Corey and Gilson Fraction Collectors

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MANY separations commonly made in laboratories today would be completely impractical without dependable fraction collectors. Simple changes in two designs are given which remedy difficulties encountered in their practical operation.

SCHROEDER AND COREY FRACTION COLLECTOR

The first design, the automatic weight-driven, time-controlled collector described by Schroeder and Corey [ANAL. CHEM. 23, 1723 (1951)], is satisfactory where column flow rates are very low, as in the Stein-Moore starch chromatographic methods [*J. Biol. Chem.* 176, 337 (1948)]. However, with higher flow rates, drops of effluent are more apt to be lost as the tube position is changed, since for a period of about 5 seconds during each change, the tubes are out of position and any drop that falls is lost.

Design Changes. The drawings in Schroeder and Corey's paper illustrate minor design changes that might be made to minimize this disadvantage. The pause between tubes can be eliminated if the stops on the trigger bar *O* (Schroeder and Corey, Figure 2, p. 1723), are made the same angular distance apart as are the holes for the test tubes in the turntable. Then, every other index pin is removed so as to make the angular distance between the pins twice that between the test tubes. With these spacings, during stage 2 (Figure 3, p. 1723) tube 2 is in position instead of midway between as in the original design.

The action of the solenoid also must be changed. This can be done by the use of a stepping relay in conjunction with a pulse timer such as that mentioned by Schroeder and Corey (R. W. Cramer Co., Type V-60M). The stepping relay alternately opens and closes a pair of contacts when activated by the pulse from the timer. The stepping relay in turn activates the solenoid during one cycle and deactivates it during the next. (A suitable relay is Type RC-100-AR Guardian locking relay, Almo Radio Corp., Philadelphia, Pa.) The solenoid operating the trigger bar is rated for continuous duty and has not shown any tendency to overheat under the conditions of operation, unless the trigger mechanism jams in some way so that the armature cannot pull into its normal position. To protect the equipment under these conditions, a time-lag fuse or a circuit breaker of the correct size can be installed in the line.

GILSON FRACTION COLLECTOR

The second design is the commercially available Gilson volumetric fraction collector (Gilson Medical Electronics, Madison, Wis.).

The fractions are measured in a volumetric tube fitted with a valve at the lower end, which is operated by a dumping mechanism. A photocell is placed on the opposite side of the volumetric tube from a fluorescent tube used as the light source. When a clear solution fills the volumetric tube, the latter acts as a cylindrical lens and increases the intensity of the light falling on the photocell, which in turn activates the dumping mechanism.

Difficulties arise if the effluent solution becomes colored or turbid and thus causes a decrease in the intensity of the light falling on the opening of the photocell. Even if the solution becomes clear later, further fractionation does not occur, as the remaining effluent overflows at the top of the volumetric tube when the photocell fails to operate the mechanism.

Design Changes. TIME CONTROL OPERATION. One way to obtain fractionation where colored or turbid solutions are encountered, is to convert to time control operation. The dumping operation in the Gilson machine is started by closing a switch in the Weston meter-type relay. A timer which will reset itself and close a switch at the end of its timing cycle thus can be used to control the machine. These requirements are met by the combination of a pulse timer (Type V-60M, R. W. Cramer Co.) and a cycle timer (CF3-2-60S, R. W. Cramer Co.) suggested by Schroeder and Corey. The pulse timer is used to start the cycle timer in the same way as for the Schroeder and Corey design. The second cam of the cycle timer is set to close its switch for a very short period (less than 4 seconds). This switch is then connected in parallel with the output terminals of the Weston meter-type relay of the Gilson machine. (The switch should be isolated from the 115-volt supply to the timer so that a short circuit will not be introduced.) For this method of operation, the fluorescent tube of the Gilson machine is removed so that the photocell does not operate.

SAFTEY DEVICE. An alternative and better way to operate the Gilson machine is to employ the timer as a safety device which goes into action if the photocell fails to operate the machine. The timer is set for a period slightly longer than is normally required for the collection of a fraction. This method requires that the timer be reset when the dumping mechanism operates; otherwise, if the photocell activates the system the timer soon will be out of step. A simple way of accomplishing this is by use of a timer which will reset itself when the power supply is interrupted.

The power supply can be interrupted by use of the microswitch connected to and operated by the dump motor of the Gilson machine. When the machine is turned on but not dumping, the normally open contact of this switch is connected to one side of the 115-volt supply line. When the machine dumps, this connection is broken. Thus if the timer is supplied from this normally open contact and from the other side of the supply line feeding the dumping mechanism, power to the timer is interrupted each time the dumping mechanism operates. (A wiring diagram illustrating this hookup can be supplied upon request.)

The pulse timer mentioned above does not reset itself on power interruption. A suitable timer for this application is the Microflex reset timer (Eagle Signal Corp., Moline, Ill.). This timer contains a switch which can be set so that it is closed at the end of the timing cycle and is open both when the timer is reset and during timing. This switch can be connected across the meter relay output terminals, as mentioned previously. The timer also can be set so that a power interruption will cause it to reset itself to zero time.

If the connections are made through a socket on the dumping mechanism cabinet and a corresponding plug on the end of a four-wire cable to the timer, the timer can be disconnected readily. This is helpful when a chromatogram is being started or at other stages of operation when the flow rate is varying over a wide range. With this method of operation, when a turbid or colored solution passes through the volumetric tube, the timer will cause fractionation to continue until a clear solution again appears, at which time the photocell will resume operation. Although the fractions will be slightly large while the timer is acting, fractionation will be obtained and the effluent will not overflow into the drain.

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